ISSN 1809-127X (online edition)
© 2010 Check List and Authors
Open Access | Freely available at *www.checklist.org.br*

Check List
Journal of species lists and distribution

NOTES ON GEOGRAPHIC DISTRIBUTION

Mollusca, Scaphopoda, Gadilidae, *Striocadulus magdalenensis* Gracia and Ardila, 2009: First record of the genus and species from Brazil

Carlos Henrique Soares Caetano [1*] and Franklin Noel dos Santos [2]

1 Universidade Federal do Estado do Rio de Janeiro – UNIRIO, Departamento de Zoologia. Avenida Pasteur, 458, sala 309, Urca. CEP 22290-240. Rio de Janeiro, RJ, Brazil.
2 Universidade de São Paulo, Museu de Zoologia. Avenida Nazaré, 481, Ipiranga. CEP 04263-000. São Paulo, SP, Brazil.
* Corresponding author. E-mail: *chcaetano@zipmail.com.br*

ABSTRACT: *Striocadulus magdalenensis* Gracia and Ardila, 2009 was collected from Brazilian deep waters (700 meters) at North Brazil, off Amapá. This species is characterized by a large shell (length up to 32 mm) and slender profile, wich resembles a *Gadila*, but with the entire external shell surface longitudinally sculptured with fine, flattened striae of equal length and evenly spaced. This new record, the second to the Atlantic Ocean, extends considerably southwards the distributional range for the genus *Striocadulus.*

Scaphopods are exclusively marine infaunal molluscs that have a worldwide distribution ranging from intertidal to dephts in excess of 6,000 m. They are characterized by a tubular external shell, open at both ends and with some degree of curvature. An increase in the shell diameter is also observed towards the anterior aperture of shell (Reynolds 2002).

The class Scaphopoda comprises 565 valid Recent taxa (Steiner and Kabat 2004; Caetano and Absalão 2005; Caetano *et al.* 2006; Scarabino 2008; Scarabino and Caetano 2008; Gracia and Ardila 2009; Simone 2009; Scarabino and Scarabino 2010) and in Brazil, a total of 36 species are recorded until this time (Scarabino and Caetano 2008; Caetano and Scarabino 2009; Simone 2009; Caetano *et al.* 2010). Scaphopods molluscs are included within the main invertebrate groups in terms of abundance or frequence of Brazilian benthos (Amaral and Jablonski 2005). On the other hand, aspects of taxonomy and biology of the scaphopods were studied by few authors (Penna 1972; Penna-Neme 1974; Caetano and Absalão 2005; Caetano *et al.* 2006, 2010; Massud-Ribeiro and Caetano 2006; Scarabino and Caetano 2008). So, the combination of the insufficient number of studies and personal observations from the examination of material from several Brazilian localities lead us to believe that this biodiversity has being underestimated, mainly because of the scarce knowledge about deep water forms.

In this work, we present a contribution to this goal with the first report of the genus *Striocadulus* based in a one specimen (empty shell) of *Striocadulus magdalenensis* collected in deep waters off Amapá, North Brazil.

The material studied is derived from oceanographic expeditions realized at Amapá coast during the years of 2004-2006 within the project "Monitoramento Ambiental - Atividade de Perfuração Marítima, Bacia da Foz do Amazonas" of British Petroleum, at a depth of 700 meters with use of Box Corer.

Identification was based on comparisons of shell morphology with original descriptions and illustrations. Shell measurements were taken according to Caetano and Absalão (2005). Material examined was deposited at the (IBUFRJ) Departamento de Zoologia, Instituto de Biologia, Universidade Federal do Rio de Janeiro, Brasil.

Abreviations: L, length; Max, maximum diameter; Dmax, distance of point of maximum diameter from anterior aperture; Arc, maximum curvature; Larc, distance of point of maximum curvature from the apex; Ha, anterior aperture height; Wa, anterior aperture width; Hp, apical aperture height; Wp, apical aperture width.

Striocadulus Emerson, 1962

Type species: *Cadulus albicomatus* Dall, 1889 (original designation); off Manta, Ecuador, and the Gulf of Panama in deep water.

Distribution: Recent, Pacific and Indian Ocean (Scarabino 1995), and Atlantic Ocean: Caribbean Sea (Gracia *et al.* 2005; Gracia and Ardila 2009), Brazil: Amapá (this study).

Diagnosis (from Scarabino 1995): "Shell medium to large, strong, polished, white, maximum diameter in anterior third. Sculptured with numerous close, fine, longitudinal striae throughout. Subcircular in section, dorsoventrally compressed. Apex strong, with two weak, flat lateral lobes, preapical callus proeminent. Radula similar to that of *Siphonodentalium* [rachidian teeth variable in shape, usually with broad base and cusped anterior border; lateral teeth strong with wide head, well armed; marginal teeth usually long]".

Striocadulus magdalenensis Gracia and Ardila, 2009 (Figures 1-5)

Striocadulus magdalenensis Gracia and Ardila, 2009: 145, figs. 2-8, 16-17.

Striocadulus sp.: Gracia *et al.*, 2005: 332, pl.1, fig. 6.

Description: Large shell (length up to 32 mm); white, smooth and translucent, with opaque white rings along the surface; ventral side slightly curved; maximum diameter in anterior third. Aperture subcircular in section, dorsoventrally compressed. Apex semicircular, less dorsoventrally compressed than aperture. Longitudinally sculptured with 86 fine, flattened striae of equal length and evenly spaced covering the entire external shell surface.

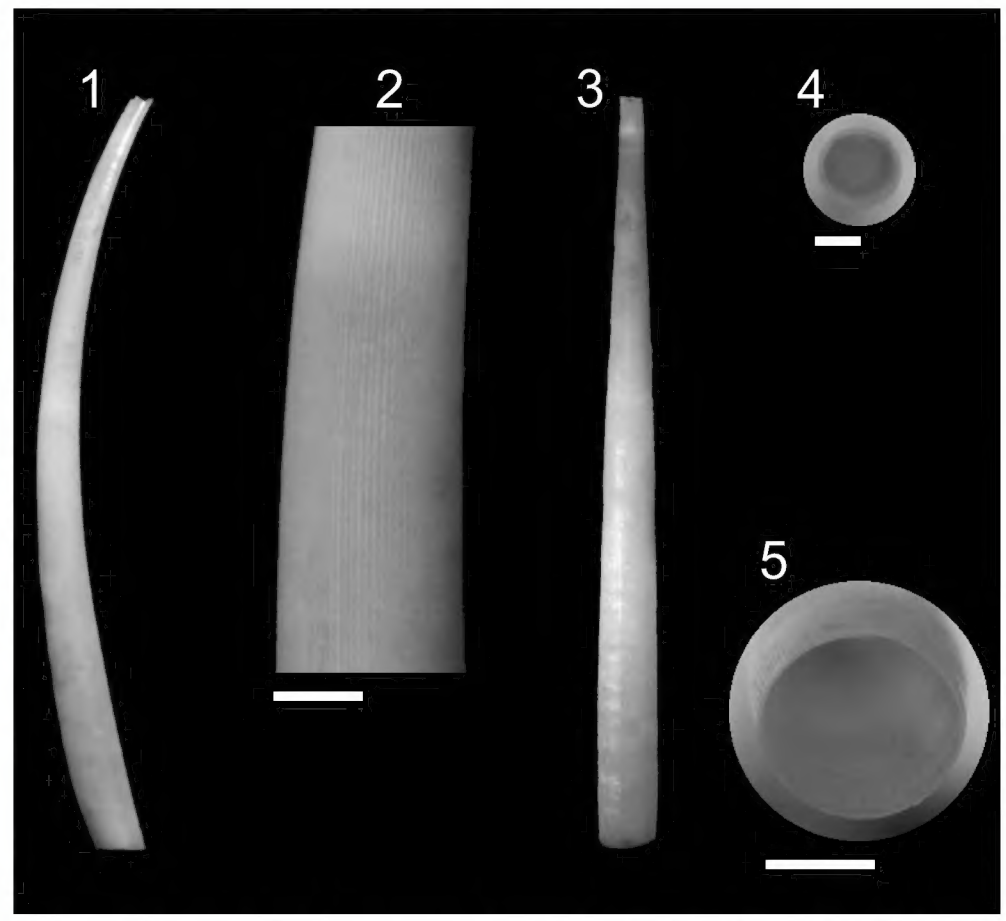
Dimensions (in mm): L – 32.6; Max – 2.6; Dmax – 5.2; Arc – 3.0; Larc – 12.9; Ha – 2.2; Wa – 2.5; Hp – 1.2; Wp – 1.3

Material examined: IBUFRJ 17015, off Amapá (03°25' N, 48°03' W), 14.12.2005, 1 empty shell, 700m.

Remarks: Emerson (1962) proposed *Striocadulus* as a subgenus of shell sculptured *Cadulus*. Palmer (1974) proposed that the genera included by Emerson (1962) under "*Cadulus* sensu lato" should be given full generic rank, thus considering *Striocadulus* as a distinctive genus. According to Steiner and Kabat (2004), four species are assigned to the genus: *Striocadulus albicomatus* (Dall, 1890); *S. ludbrooki* Scarabino, 1995; *S. pulcherrimus* (Boissevain, 1906) and *S. sagei* Scarabino, 1995. Gracia *et al.* (2005) studied the Scaphopoda of the Colombian Caribbean and reported, for the first time, a species of *Striocadulus* from the Atlantic Ocean. The material studied by these authors consists of four specimens (shells plus soft parts) and was tentatively identified as *Striocadulus* sp. More recently, Gracia and Ardila (2009) described *Striocadulus magdalenensis* from Colombia based in the referred material. The species of *Striocadulus* are known to be bathyal, ranging from 400 to 3000m (Table 1). The report of *S. albicomatus* at 41-73 m off Mexican Pacific coast (Ríos-Jara *et al.* 2003a, b) seems to be erroneous, since that the same species is known from much deeper waters (between 731-3056 m).

Our unique shell is higher in shell length and in the most of morphometric values than that Colombian material (Table 2), and presented a higher number of longitudinal striae (84 from Brazilian material *vs.* 66-73 from Colombian material). Gracia and Ardila (2009) stated that the apex of *S. magdalenensis* has traces of four lobes, but apical characters are not clearly shown in Brazilian material. For the other species of *Striocadulus*, the presence of two lobes has been observed (Scarabino 1995).

Among the others Brazilian scaphopods, a first view of *Striocadulus* could be confounded with species of *Gadila*, but examination under magnification clearly show the presence of longitudinal striae throughout shell surface that splits *Striocadulus* from *Gadila*.



Figures 1-5. *Striocadulus magdalenensis*, IBUFRJ 17015, shell length = 32.6 mm. (1) shell - lateral view, (2) detail of shell surface showing longitudinal striae, (3) shell - dorsal view, (4) apex - cross section, (5) aperture - cross section. Scale bars: (2) and (5) = 1 mm, (4) = 500 μm.

Table 1. Geographical distribution and range extension for species of the genus *Striocadulus*.

Taxa	Localities	Depth range (m)	Source
Striocadulus magdalenensis	Atlantic Ocean, Colombia and Amapá, North Brazil	404-700	Gracia and Ardila (2009), this study
Striocadulus albicomatus	Eastern Pacific, Ecuador, Gulf of Panamá	731-3056	Steiner and Kabat (2004)
Striocadulus ludbrooki	Indian Ocean, Red Sea	528-732	Scarabino (1995)
Striocadulus pulcherrimus	Indo-Pacific, Indonesia	530-694	Scarabino (1995)
Striocadulus sagei	Indo-Pacific, Indonesia and Philippines	520-835	Scarabino (1995)

Table 2. Values of shell morphometrics parameters for *Striocadulus magdalenensis* (from Brazil and Colombia), *S. ludbrooki* and *S. sagei*. L, length; Max, maximum diameter; Dmax, distance of point of maximum diameter from anterior aperture; Arc, maximum curvature; Larc, distance of point of maximum curvature from the apex; Ha, anterior aperture height; Wa, anterior aperture width; Hp, apical aperture height; Wp, apical aperture width. All measurements are in millimeters. * Statistical descriptors derived from the data obtained by Gracia and Ardila (2009). ** Data obtained from holotype measurements given by Scarabino (1995).

		L	Max	L : Max	Dmax	Arc	Larc	Ha	Wa	Ha : Wa	Hp	Wp	Hp : Wp
S. magdalenensis	Brazil (n = 1)	32.6	2.6	12.5	5.2	3.0	12.9	2.2	2.5	0.8	1.2	1.3	0.9
	Colombia* (n = 4)	24.1	2.7	8.8	4.4	1.9	12.9	2.1	2.5	0.8	1.3	1.4	0.9
	mean (±SD)	(3.6)	(0.1)	(1.0)	(1.0)	(0.7)	(1.9)	(0.1)	(0.1)	(0.0)	(0.1)	(0.1)	(0.0)
S. ludbrooki **		19.5	3.0					2.0			1.4		
S. sagei **		40.0	4.5					3.9			1.6		

Acknowledgments: The authors express their deepest gratitude to Dr. Alexandre D. Pimenta (Museu Nacional-UFRJ) and Dr. Victor Scarabino (Museo Nacional de Historia Natural, Montevideo) for critical reading of and valuable suggestions on the final manuscript. Thank also to FAPERJ ("Fundação Carlos Chagas Filho de Amparo à Pesquisa do Estado do Rio de Janeiro") for financial support (process E-26/111.030/2009) and to Dr. Janet W. Reid for the improvement of the English text.

Literature Cited

Amaral, A.C.Z. and S. Jablonski. 2005. Conservation of marine and coastal biodiversity in Brazil. *Conservation Biology* 19(3): 625-631.

Caetano, C.H.S. and R.S. Absalão. 2005. A new species of the genus *Polyschides* Pilsbry and Sharp, 1898 (Mollusca, Scaphopoda, Gadilidae) from Brazilian waters. *Zootaxa* 871: 1-10.

Caetano, C.H.S. and V. Scarabino. 2009. Class Scaphopoda; p. 444-457 *In* E. Rios (org.). *Compendium of Brazilian Sea Shells*. Rio Grande: Evangraf.

Caetano, C.H.S., V. Scarabino and R.S. Absalão. 2006. Scaphopoda (Mollusca) from the Brazilian continental shelf and upper slope (13° to 21°S) with descriptions of two new species of the genus *Cadulus* Philippi, 1844. *Zootaxa* 1267: 1-47.

Caetano, C.H.S., V. Scarabino and R.S. Absalão. 2010. Brazilian species of *Gadila* (Mollusca: Scaphopoda: Gadilidae): rediscovery of *Gadila elongata* comb.nov. and shell morphometrics. *Zoologia* 27(2): 1-4.

Emerson, W.K. 1962. A classification of the scaphopod mollusks. *Journal of Paleontology* 36(3): 461-482.

Gracia, A. and N.E. Ardila. 2009. *Striocadulus magdalenensis*, a new deep-sea scaphopod (Mollusca, Scaphopoda, Gadilidae) from the Colombian Caribbean. *Boletín de Investigaciones Marinas y Costeras* 38(1): 143-150.

Gracia, A., N.E. Ardila, P. Rachello and J.M. Díaz. 2005. Additions to the scaphopod fauna (Mollusca: Scaphopoda) of the Colombian Caribbean. *Caribbean Journal of Science* 41(2): 328-334.

Massud-Ribeiro, R. and C.H.S. Caetano. 2006. The use of scaphopods (Mollusca) empty shells by sipunculids and crustacean at Brazilian coast. *Biociências* 14(1): 85-87.

Penna, L. 1972. Moluscos da Baía da Ilha Grande, Rio de Janeiro, Brasil. I. Scaphopoda (Dentaliidae). *Papéis Avulsos de Zoologia* 25(22): 229-236.

Penna-Neme, L. 1974. Considerações sobre os Scaphopoda (Mollusca) da costa brasileira, com descrição de uma nova espécie. *Papéis Avulsos de Zoologia* 28(6): 105-126.

Reynolds, P.D. 2002. The Scaphopoda. *Advances in Marine Biology* 42: 137-236.

Ríos-Jara, E., E. López-Uriarte, M. Pérez-Peña and E. Juárez-Carrillo. 2003a. Nuevos registros de escafópodos para las costas de Jalisco y Colima, México. *Hidrobiológica* 13(2): 167-170.

Ríos-Jara, E., M. Pérez-Peña, E. López-Uriarte and E. Juárez-Carrillo. 2003b. Moluscos escafópodos de la campaña Atlas V (Plataforma continental de Jalisco y Colima, México) a bordo del B/O El Puma. *Ciencias Marinas* 29(1): 67-76.

Scarabino, V. 2008. New species and new records of scaphopods from New Caledonia. *In* V. Héros, R.H. Cowie and P. Bouchet (ed.). Tropical Deep Sea Benthos, volume 25. *Mémoires du Muséum national d'Histoire naturelle* 196: 215-268.

Scarabino, V. and C.H.S. Caetano. 2008. On the genus *Heteroschismoides* Ludbrook, 1960 (Scaphopoda, Gadilida, Heteroschismoidinae), with description of two new species. *The Nautilus* 122(3): 171-177.

Scarabino, V. and F. Scarabino. 2010. A new genus and thirteen new species of Scaphopoda (Mollusca) from the tropical Pacific Ocean. *Zoosystema* 32(3): 409-423.

Simone, L.R.L. 2009. Comparative morphology among representatives of main taxa of Scaphopoda and basal protobranch Bivalvia (Mollusca). *Papéis Avulsos de Zoologia* 49(32): 405-457.

Steiner, G. and A.R. Kabat. 2004. Catalogue of species-group names of Recent and fossil Scaphopoda (Mollusca). *Zoosystema* 26(4): 549-726.

Received: October 2010
Revised: November 2010
Accepted: November 2010
Published online: December 2010
Editorial responsibility: Luis Ernesto Arruda Bezerra